REMARKS

The Office Action mailed November 10, 2003, has been carefully considered.

In the Office Action, the Examiner rejected claims 1-5, 7, 53-57, 59, and 105-109 and 111 under 37 U. S. C. §103 as being unpatentable over U. S. Patent No. 6,603,473 to Litke et al (hereinafte "Litke"). In addition, the Examiner rejected claims 6, 58 and 110 as being unpatentable over Litke in view of Levin "Interpolating nets of curves by smooth subdivision surfaces," ACM 1999, 57-64. The Examiner indicated that claims 8-52, 60-104 and 112-156 were objected to, but would be allowable if rewritten in independent form.

Preliminarily, Applicant thanks the Examiner for the indication of allowable subject matter.

Applicant has reviewed the claims, and has amended claims 1, 53 and 105 to provide an antecedent basis for "vertex." In addition, Applicant is amending claims 2, 4, 54, 56, 106 and 108 to correct obvious grammatical errors.

Applicant respectfully submits that the claims patentably distinguish over the references.

Applicant will initially address independent apparatus claim 1 as also representative of independent computer program product claim 53 and independent method claim 105. Claim 1 is directed to an arrangement for generating a representation of a feature in a surface defined by a mesh representation. The mesh comprises at a selected level a plurality of points including at least one point, referred to as a vertex, connected to a plurality of neighboring points by respective edges. The feature is defined in connection with the vertex and at least one of the neighboring points and the edge interconnecting the vertex and the at least one of the neighboring points in the mesh representation. The feature generating arrangement is recited as comprising a weight vector generator module and a feature representation generator module. The weight vector generator module is configured to generate at least one weight vector based on a parameterized subdivision rule defined at a plurality of levels, for which a value of at least one parameter differs at at least two levels in the mesh. The feature representation generator module is configured to use the at least one weight vector and positions of the vertex and the neighboring points to generate the representation of the feature.

The Examiner rejected claim 1 as being unpatentable over Litke. The Litke patent is directed to what is referred to as "detail data" pertaining to the shape or contour of an object's surface. For a respective vertex in a mesh, the "detail data" is in the form of a "detail vector" that provides information as to the intended shape or contour of the surface of the object proximate the limit point of the vertex with which the detail vector is associated. Litke, in connection with the stencils depicted in FIGs. 6A through 6C and 7A through 7C, and associated text, also describes various methodologys for performing mesh subdivision from one level to another to obtain subdivision surfaces. In Litke, the detail vector associated with a vertex is generated in relation to one or more "difference vectors." A difference vector associated with a vertex in a mesh representation indicates the difference between the position of the respective vertex in the mesh representation and the limit point for the vertex on the limit surface associated with the mesh representation. Litke describes a several methodologies for generating a detail vector. In addition, Litke describes a methodology for propagating difference vectors from one subdivision level to the next subdivision level. Weights that are assigned to the detail vectors for detail vector propagatio are also specified by stencils, which are described in connection with FIGs. 7D through 7F and 8A through 8C, and associated text.

Applicant respectfully submits that claim 1 patentably distinguishes over Litke, at least for the reason that Litke does not teach or suggest a *parameterized* subdivision rule *for which the value of the parameter differs at two levels in the mesh.* Applicant does acknowledge that Litke teaches a *subdivision rule,* indeed several subdivision rules, as noted above. Applicant respectfully submits, however, that the subdivision rules are not *parameterized.* subdivision rules. Moreover, Applicant submits that there is no suggestion of a subdivision rule for which the value of a parameter differs at at least two levels in the mesh.

Regarding the first, that the subdivision rules are not *paramaterized,* Applicant notes that Webster's dictionary, at HTTP://www.m-w.com, defines "parameter" as "an *arbitrary* constant whose value characterizes a member of a system," and in computer programming usually refers to a value that is provided to a routine by a user or calling program when the routine is executed. By calling for a parameterized subdivision rule, with the value of the parameter differing as between two levels, the claim provides that the subdivision rule may provide that the weights that are to be applied in connection with the subdivision rule at the two levels may differ.

This is not the case with the subdivision rules described in Litke. FIGs. 6A through 6C and related text describe Litke's subdivision rules for interior vertices. A review of those rules makes clear that the weights to be applied will not vary as among the various levels. For the subdivision rule described in relation to FIG. 6A (reference column 6, lines 25 through 43), which determines the position of an "even" interior vertex in the finer mesh (that is, the rule determines the position, in the finer mesh, of an interior vertex that exists in the coarser mesh), the rule depends only on the number of vertices that neighbor the vertex for which the rule is to be applied, that is, the vertex's valence. For the subdivision rule described in relation to FIG. 6B (reference column 6, lines 44 through 58), which determines the position of an interior odd vertex in the finer mesh (that is, the position of a vertex that is to be added to the finer mesh) that is not proximate a corner vertex, the rule applies fixed weights in relation to the positions in the coarse mesh of four nearby vertices.

For the subdivision rule described in relation to FIG. 6C (reference column 6, line 59, through column 7, line 28), which determines the position of an interior odd vertex in the finer mesh that is proximate a corner vertex, the rule applies weights that are determined in relation to the valence of the corner vertex and the angle of the tangents to the boundary curves that intersect at the corner vertex. As will be described below in connection with the subdivision rules described in connection with FIGs. 7A through 7C, the boundary curves that intersect to form the corner vertex, apparently as with all boundary curves, are defined by parametric equations, and there is no indication in Litke that the parametric equations be changed as between the coarse level and the finer level. Accordingly, it would appear that the tangents to the boundary curves at the corner vertex will not vary as between the coarse level and the finer level. Since it appears that neither the valence nor the equations of the boundary curves vary as among the various levels, the weights also would presumably not vary as among the various mesh levels. It should be noted that, even if there were a change in the parametric equation for the boundary curves as between a coarse level and a fine level, there is no suggestion that the change would result from a parameter provided by a user or calling program.

FIGs. 7A through 7C and related text describe Litke's subdivision rules for boundary vertices. A review of those subdivision rules also makes clear that the weights to be applied will not vary as among the various levels. Moreover, it is clear that the subdivision rules are structured so as to determine the values of the parameters used in parametric equations of the boundary curves. The value of the parameter associated with a particular vertex determines the position of the respective

vertex along the respective boundary curve(s) on which the vertex lies. For example, the subdivision rule defined in relation to FIG. 7C (reference column 8, lines 6 through 17), which determines the position of the corner vertex in the finer mesh, the rule applies a weight is fixed at "one." This will provide that the values of the parameters in the parametric equations of the boundary curves that intersect at the corner vertex will be the same in the finer mesh as in the coarse mesh, thereby to ensure that the position of the corner vertex in the finer mesh is the same as the position in the coarse mesh.

For the subdivision rule defined in relation to FIG. 7A (reference column 7, lines 46 through 60), which determines the position of an even boundary vertex (that is, the rule determines the position, in the finer mesh, of a boundary vertex that exists in the coarser mesh), the rule is such that fixed weights are applied to (a) the parameter used in the parametric equation of the boundary curve to define the position, in the course mesh, of the vertex whose position is being determined in the finer mesh, and (b) the parameters in the parameter equation to define the positions, in the course mesh of the neighboring vertices along the boundary curve. Similarly, for the subdivision rule defined in relation to FIG. 7B (reference column 7, line 61, through line 8, column 5), which determines the position of an odd boundary vertex (that is, the position of a vertex that is to be added to the finer mesh), the rule is such that fixed weights are applied to the parameters in the parameter equation to define the positions, in the course mesh of the neighboring vertices along the boundary curve.

Accordingly, Applicant respectfully submits that Litke neither teaches nor suggest a a *parameterized* subdivision rule defined at a plurality of levels, *for which a value of at least one parameter differs at at least two levels in the mesh*, as required in the claim.

Litke, in connection with FIGs. 7D through 7F, and related text, also discloses rules for propagating detail vectors from one subdivision level to the next, but Applicant respectfully submits that those are not subdivision rules. Subdivision rules define the positions of vertices in a finer mesh, in relation to the positions of vertices in the coarser mesh. As described above, Litke describes the detail vectors as providing information as to the intended shape or contour of the surface of the object proximate the limit point of the vertex with which the detail vector is associated. Accordingly, Litke's detail vector propagation rules are not subdivision rules, since they do not determine the position of any vertex. In any case, like Litke's subdivision rules, Litke's detail vector propagation rules

described in connection with FIGs. 7D through 7F apply fixed weights to detail vectors associated with the coarse mesh in propagating them to the finer mesh. There is no suggestion that the detail vector propagation rules make use of use of a parameter whose value differs at at least two levels in the mesh.

In view of the above, Applicant respectfully submits that Litke neither teaches nor suggests the invention recited in claim 1.

In view of the above, Applicant respectfully submits that there is no suggestion that any of the subdivision rules that are disclosed in Litke are parameterized. Accordingly, Applicant respectfully submits that Litke neither teaches nor suggests the invention recited in claim 1.

Applicant further submits that computer program product claim 53 and method claim 105 patentably distinguish over Litke for the reasons recited above in connection with claim 1.

Applicant further submits that dependent claims 2 through 52, 54 through 104 and 106 through 156 are allowable at least for the reason that they depend from allowable independent claims.

It is believed that this application is allowable, and a notice of allowability is respectfully solicited.

Respectfully submitted,

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